SUPPORT FOR THE AMENDMENT

Support for the amendment to claim 13 is found on page 9, lines 9-12 in the specification. No new matter would be added to this application by entry of this amendment.

Upon entry of this amendment, claims 1-13 will remain active in this application.

REQUEST FOR RECONSIDERATION

The claimed invention is directed to a process for improving the hydrolysis resistance of a urethane elastomer, a polyester polyol which may be used to form a urethane elastomer, a urethane elastomer obtained by reacting a polyester polyol and a method of preparing a shoe sole.

Urethane elastomers are commercially important but have suffered from insufficient resistance to hydrolysis in some applications. Methods to improve hydrolysis stability have not been entirely satisfactory in view of cost and performance. Accordingly, methods of improving the hydrolysis resistance of a urethane elastomer are sought.

The claimed invention addresses this problem by providing a process for preparing a urethane elastomer comprising reacting a hydroxylated compound with a prepolymer in which the hydroxylated compound comprises a first polyester polyol resin prepared by reacting at least one C_{8-12} aliphatic dicarboxylic acid and *ortho*-phthalic acid or an anhydride thereof, with at least one polyol. Applicant has discovered that a hydroxylated compound comprising a polyester polyol resin obtained by reacting a C_{8-12} aliphatic dicarboxylic acid and *ortho*-phthalic acid or its corresponding anhydride with at least one polyol, to provide for a hydrolysis resistant urethane elastomer. Such a process, polyester polyol resin or urethane elastomer are nowhere disclosed or suggested in the cited references.

The rejection of claims 7-11 under 35 U.S.C. §102(b) over Seiwert et al., U.S. 3,349,049 is respectfully traversed.

Seiwert et al. fails to disclose or suggest a polyester comprising $\mathbf{C_{8\text{-}12}}$ aliphatic dicarboxylic acid **and *ortho*-phthalic acid** reacted with at least one polyol.

Seiwert et al. is directed to an intermediate polyester reactant prepared from a combination of 10-80 mol% of **long chain** dicarboxylic acid prepared by the polymerization of a C_{18} unsaturated acid and 20-90 mol% of a low molecular weight, unsaturated dicarboxylic acid such as maleic, phthalic, succinic, or anhydrides thereof, isophthalic, fumaric or mixtures thereof (beginning at column 1, line 67 through column 2, line 7). The reference also discloses at column 1, lines 17-22 a previously known intermediate polyester prepared by reacting saturated polyols such as ethylene glycol, diethylene glycol, propylene glycol, glycerin, trimethylpropane or butylene glycol with **a relatively short chain** aliphatic saturated dibasic acid such as adipic, azelaic or sebacic acid. The combination of unsaturated dibasic acid with a $C_{8\text{-}12}$ aliphatic carboxylic acid is not disclosed. Thus, the intermediate polyesters described by this reference are either 1) the combination of long chain dicarboxylic acid prepared by polymerizing a C_{18} unsaturated acid with a low molecular weight, unsaturated dibasic acid and 2) the reaction product of a saturated polyol with a relatively short chain aliphatic dibasic acid. The combination of $C_{8\text{-}12}$ aliphatic dicarboxylic acid with *ortho*-phthalic acid is nowhere disclosed or suggested by the reference.

In contrast, the invention claims 7-11 is directed to a polyester polyol comprising the reaction of at least one polyol with at least one $C_{8\text{-}12}$ aliphatic dicarboxylic acid **and** *ortho*-phthalic acid. As the reference fails to disclose or suggest the specification combination claimed, the invention of claims 7-11 is clearly not anticipated by the reference.

Moreover, the claimed combination would not have been obvious as the reference describes the specific combination of polymerized C_{18} unsaturated acid with low molecular weight unsaturated dibasic acid, clearly in view of the previously known combination of aliphatic polyol with short chain aliphatic saturated dibasic acids. There is no suggestion to

combine short chain aliphatic acid with a low molecular weight unsaturated dibasic acid such as phthalic acid.

Moreover, applicant observes improved hydrolysis resistance by preparation of a urethane elastomer from a polyether polyol resin as claimed. The examiner's attention is directed to the data appearing on page 15, Table VII.

TABLE VII

	Comparative elastomers C1-3			Elastomers E1-3		
	C1	C2	C3	E1	E2	E3
Prepolymer	P1					
Polyester polyol resin		B1			A1	
Reaction Parameters						
NCO:OH ratio	98:100	100:100	102:100	98:100	100:100	102:100
Creme time (s)		5-6			5-6	
Tack free time (s)		21-23			18-20	
Setting time (s)		34-36			32-34	
Free density		0.34			0.33	
Lifting time in min		2			2	
Molding temperature in ° C.		55			55	
Physical and Mechanical Properties*						
Molding density		0.6			0.6	
Shore A hardness	49	50	51	43	42	44
Elongation %	520	475	505	540	535	495
Breaking load						
before hydrolysis MPa	7.4	7.0	6.7	6.0	6.1	6.1
Hydrolysis at 9 days MPa (% ret.)	4.5 (61)	5.5 (79)	54. (81)	5.5 (92)	5.7 (95)	5.8 (97)
Hydrolysis at 12 days MPa (% ret.)	3.6 (49)	4.8 (69)	5.0 (75)	5.1 (85)	5.4 (90)	5.5 (92)
Hydrolysis at 15 days MPa (% ret.)	1.0 (15)	1.7 (24)	2.0 (30)	4.9 (81)	5.4 (90)	5.2 (87)
Hydrolysis at 18 days MPa (% ret.)	0.4 (5)	1.3 (19)	1.8 (27)	4.6 (77)	5.1 (85)	5.2 (87)
Hydrolysis at 22 days MPa (% ret.)	0	0	0	4.0 (67)	4.8 (80)	4.8 (80)
Hydrolysis at 25 days MPa (% ret.)	0	0	0	2.9 (48)	4.15 (69)	4.4 (73)
Tearing N/mm	30	28	27	26	24	23
Ross Flex at 20° C., kilocycles for 500% propagation of the starter cut	>200	180	170	>200	>200	120

*performed on sheets 6 mm thick

Comparative Elastomer C1-3 were prepared from polyester polyol resin B1. The reaction product of adipic acid and monoethylene glycol and 1,4-butane diol. While the initial breaking load, prior to hydrolysis ranged from 6.7-7.4 MPas, after eighteen days, the

breaking load dropped to 0.4-1.8 MPa, only 5-27% of the original breaking load. After 22 days, the breaking load dropped to 0 MPa.

In contrast, elastomers E1-3 prepared from polyester polyol resin A1, a mixture of phthalic anhydride/sebacic acid and diethylene glycol exhibited much greater breaking load under hydrolysis conditions retaining from 77-87% or the original break load after 18 days and 48-73% of the original breaking load after **twenty-five** days. Thus, the evidence demonstrates an improved hydrolysis resistance using a combination of phthalic acid and C_{8-12} aliphatic dicarboxylic acid.

Table VIII appearing on page 17 provides hydrolysis data when the comparative polyester polyol resin is B2 a mixture of adipic acid and monoethylene glycol, diethylene glycol and trimethylol propane.

[0069]

TABLE VIII

	Comparative elastomer C4	Elastomer E4
Prepolymer	P1	
Polyester polyol resin	B2	A1
Reaction Parameters		
NCO:OH ratio	63:100	73:100
Creme time (s)	—	—
Tack free time (s)	16–18	19–21
Setting time (s)	26–28	36–38
Lifting time in min	2	2
Molding temperature in ° C.	45	45
Physical and Mechanical Properties*		
Molding density	1.05	1
Shore A hardness	60–61	63–64
Elongation %	565	575
Breaking load		
before hydrolysis MPa	12.1	13.7
Hydrolysis at 5 days MPa (% ret.)	69	79
Hydrolysis at 7 days MPa (% ret.)	43	72
Hydrolysis at 9 days MPa (% ret.)	32	70
Hydrolysis at 14 days MPa (% ret.)	0	47
Hydrolysis at 21 days MPa (% ret.)	0	32
Tearing N/mm	53	44
Ross Flex at 20° C., kilocycles for 500% propagation of the starter cut	65	70

*performed on sheets 6 mm thick

The data appearing in Table VIII, comparative elastomer C4 demonstrated only 32% retention of break load after nine days and no detectable break load after fourteen days. In contrast, elastomer E4 prepared with polyester polyol resin A1 retained 70% of break load after nine days and 32% after twenty-one days.

The data in Table IX appearing on page 19 again compares elastomers prepared from polyester polyols B1 with A1.

[0073]

TABLE IX

	Comparative elastomer C5	Elastomer E5
Prepolymer	P1	P2
Polyester polyol resin	B1	A1
Reaction Parameters		
NCO:OH ratio	99:100	95:100
Creme time (s)	5–6	4–5
Tack free time (s)	23–25	16–18
Setting time (s)	43–45	32–34
Free density	0.32	0.30
Lifting time in min	2.25	2
Molding temperature in ° C.	45	45
Physical and Mechanical Properties*		
Molding density	0.6	0.6
Shore A hardness	52	54
Elongation %	380	310
Breaking load		
before hydrolysis MPa	8.5	7.9
Hydrolysis at 10 days MPa (% ret.)	6.5 (76)	5.9 (75)
Hydrolysis at 15 days MPa (% ret.)	3.4 (40)	4.9 (62)
Hydrolysis at 20 days MPa (% ret.)	1.4 (16)	4.1 (52)
Hydrolysis at 25 days MPa (% ret.)	0	2.3 (32)
Hydrolysis at 30 days MPa (% ret.)	0	1.1 (14)
Tearing N/mm	33	30
Ross Flex at 20° C., kilocycles for 100% propagation of the starter cut	>150	>150

*performed on sheets 6 mm thick

The comparative elastomer C5 showed 16% retention after 20 days and no detectable breaking load at twenty-five days. In comparison, the elastomer E5 prepared with a polyester polyol according to the claimed invention exhibited 52% retention after 20 days and 32% retention of breaking load after twenty-five days.

The data on pages 21 and 22, Table X provides Comparative Elastomers C 6-9 with Elastomers E6-9, again comparing polyester polyol resins B1 with A1.

TABLE X

	Comparative elastomers C6–9				Elastomers E6-9			
	C6	C7	C8	C9	E6	E7	E8	E9
Prepolymer			P1				P1	
Polyester polyol resin			B1				A1	
Reaction Parameters								
NCO:OH ratio	99:100	101:100	103:100	105:100	110:100	112:100	114:100	116:100
Creme time (s)			4–5				5–6	
Tack free time (s)			23–26				17–21	
Setting time (s)			40–44				35–40	
Free density			0.24				0.24	
Lifting time in min			2				2	
Molding temperature in ° C.			45				45	
Physical and Mechanical Properties*								
Molding density			0.5				0.5	
Shore A hardness	39	39	?9	39	40	40	40	40
Elongation %	490	470	440	425	435	415	380	375
Breaking load								
before hydrolysis MPa	5.2	5.4	5.5	5.6	5.0	5.3	5.6	5.6
Hydrolysis at 10 days MPa (% ret.)	3.4 (65)	4.3 (80)	5(91)	5.2(93)	4 (80)	4.6 (87)	5.4 (100)	5.9(100)
Hydrolysis at 15 days MPa (% ret.)	1.8 (35)	2(37)	2(36)	2.4(43)	4 (80)	4.5 (85)	5(94)	5.2(93)
Hydrolysis at 20 days MPa (% ret.)	0.8 (15)	0.9 (17)	1.1 (20)	1.1(20)	2.8 (56)	3.1 (58)	4.2 (79)	4.6(82)
Hydrolysis at 25 days MPa (% ret.)	0	0	0	0	1.3 (26)	1.5 (28)	2(38)	2.4(43)
Hydrolysis at 30 days MPa (% ret.)	0	0	0	0	1.1 (22)	1.4 (26)	2(38)	1.5(27)
Tearing N/mm	23	21	21	21	23	22	22	21

*performed on sheets 6 mm thick

The comparative elastomers C6-9 had only 15-20% retention after 20 days and no detectable breaking load at twenty-five days whereas elastomers E6-9 retained from 56-82% after 20 days and 26-43% of the original breaking load after 25 days.

Thus, applicant has provided significant demonstration of an improved hydrolysis resistance by selection of the combination of C_{8-12} aliphatic dibasic carboxylic acid as compared with a polyester polyol (B1 and B2) prepared from adipic acid, a C_6 aliphatic dicarboxylic acid.

As the cited reference fails to disclose or suggest an improved hydrolysis resistance by selection of aliphatic C_{8-12} dicarboxylic acid and *ortho*-phthalic acid, the claimed invention is clearly neither anticipated nor rendered obvious by this reference and accordingly withdrawal of the rejection under 35 U.S.C. §102(b) is respectfully requested.

The rejection of claims 1-6 and 12 under 35 U.S.C. §103(a) over Thoma et al., U.S. 3,553,172 in view of Seiwert et al. is respectfully traversed.

Thoma et al. fails to disclose or suggest the claimed polyether polyol comprising the reaction of polyol with at least one C_{8-12} aliphatic dicarboxylic acid and *ortho*-phthalic acid. This deficiency is recognized on page 3 where the Office Action recognizes

> However, patentees are silent in teaching aromatic polyester polyol reactants consisting of sebacic acid and *ortho*-phthalic acid.

While the Examiner relies on Seiwert et al. for a description of sebacic acid in a polyether polyol as well as phthalic acid in a polyether polyol, the specific combination of C_{8-12} aliphatic dicarboxylic acid with phthalic acid is not disclosed nor the improved hydrolysis resistance resulting from the combination thereof. As such, the combination of Thoma et al. with Seiwert et al. fails to render the claimed invention obvious. Withdrawal of the rejection under 35 U.S.C. §103(a) is respectfully requested.

The rejection of claim 13 under 35 U.S.C. §103(a) over Thoma et al. in view of Seiwert et al. and in further view of Lorenz et al., U.S. 6,737,471 is respectfully traversed.

The failure of the disclosure of Thoma et al. in view of Seiwert et al. to suggest the claimed polyurethane elastomer is described above. While Lorenz et al. is relied upon for a disclosure of shoe soles based on a urethane elastomer, the deficiencies of the references of Thoma et al. in combination with Seiwert et al. to disclose or suggest the claimed urethane elastomer fails to render the claimed invention obvious. Accordingly, withdrawal of the rejection of claim 13 under 35 U.S.C. §103(a) is respectfully requested.

The rejections of claim 13 under 35 U.S.C. 112, second paragraph and 35 U.S.C. 101 has been obviated by appropriate amendment.

Claim 13 has been amended to recite a molding step in the formation of a shoe sole. Withdrawal of these grounds of rejection is respectfully requested.

Applicant notes that the reference EP 156,665 was submitted in the Information Disclosure Statement submitted on August 10, 2004. While the examiner has indicated that the reference has not been considered because no English language translation has been provided, applicant respectfully requests consideration of this reference to the extent that it is disclosed on page 2 of applicant's specification as describing the use of dimerized fatty acids to prepare a polyester polyol.(M.P.E.P 609.04(a) III)

Applicant submits that this application is now in condition for allowance and early notification of such action is earnestly solicited.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.
Norman F. Oblon

Richard L. Chinn, Ph.D.
Attorney of Record
Registration No. 34,305

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 08/07)